Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Spectrum Horizons	)	ET Docket No. 18-21
	)	
James Edwin Whedbee Petition for Rulemaking	)	
to Allow Unlicensed Operation in the 95-1000	)	RM-11795
GHz Band	)	

COMMENTS OF ERICSSON

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Ericsson submits these comments in response to the Commission's Notice of Proposed Rulemaking ("*Notice*") in the above-captioned proceeding, in which the Commission proposes to make spectrum above 95 GHz more readily accessible for new commercial services and technologies, including backhaul connectivity for 5G.[1]

I. INTRODUCTION AND SUMMARY.

Ericsson commends the Commission's initiative to unleash the above 95 GHz spectrum for commercial use. As observed in the *Notice*, "[t]he development of 5G technology, which has been driven by the ever-increasing data appetite of smartphones and other consumer devices, has created demand for more spectrum."[2] In recent years, the Commission has taken aggressive action to "[u]nlock[] a mix of new low-, mid-, and high-band spectrum for wireless use [that] will position the U.S. to win the 5G race."[3] But to win the race to 5G, the United States must

[1] *Spectrum Horizons et al.*, Notice of Proposed Rulemaking and Order, FCC 18-17 (rel. Feb. 28, 2018) ("*Notice*").

[2] *Id.* ¶ 20.

[3] CTIA, *The Global Race to 5G*, at 11 (Apr. 2018) ("CTIA 5G Report"), https://api.ctia.org-/wp-content/uploads/2018/04/Race-to-5G-Report.pdf.

ensure that wireless networks have sufficient high-capacity backhaul to carry traffic from increasingly data-rich mobile applications and the Internet of Things. The above 95 GHz spectrum at issue in the *Notice* will be an important resource for that backhaul capacity.

Ericsson is already examining how the above 95 GHz spectrum can be deployed for high-capacity backhaul. Whereas fiber backhaul in some cases may prove too expensive for connecting dense networks of small cells, high-capacity wireless backhaul can be a sound solution. In a 2017 paper titled "Microwave Backhaul Evolution – Reaching Beyond 100 GHz" (the "Ericsson Above 100 GHz Report"), Ericsson reported the following:

> The microwave backhaul industry has started preparing for the next major technology and performance leap . . . . The aim is to open up spectrum beyond 100 GHz frequencies for up toward 100 Gbps capacity to support different applications and use cases with hop distances of up to a few kilometers. In the longer term, it is expected to serve as a high capacity complement to the use of other frequency bands, especially in urban and suburban areas . . . . The smaller physical antenna size at these higher frequencies will be of particular advantage in these locations.[4]

Accordingly, Ericsson supports the Commission's proposal to set aside portions of the 95-275 GHz band for licensed, fixed point-to-point service. The Commission also should harmonize its 95-275 GHz band plan with those under consideration in Europe, so the U.S. marketplace can benefit from the economies of scale essential for global, cost-efficient products. In addition, Ericsson agrees that the Commission should use the 70/80/90 GHz "lite licensing"/link registration model for authorizing facilities at 95-275 GHz.

Subject to certain exceptions, Ericsson believes that the Commission's proposed technical rules for the 95-275 GHz spectrum – based largely on the 70/80/90 GHz model – are

[4] Jonas Edstam *et al.*, *Microwave Backhaul Evolution – Reaching Beyond 100 GHz*, Ericsson Technology Review, at 2-3 (Feb. 21, 2017) ("Ericsson Above 100 GHz Report"), https://www.-ericsson.com/assets/local/publications-/ericsson-technology-review/docs/2017/etr-beyond-100ghz.pdf.

appropriate. But the Commission should refrain from specifying transmitter power above 95 GHz in terms of maximum EIRP density, and instead apply the current 70/80/90 GHz power limit. Also, the Commission should not apply a minimum antenna gain of 50 dBi or, alternatively, 43 dBi, to above 95 GHz antennas. Antennas installed on lampposts, light poles, traffic signal masts or similar supporting structures must contend with the phenomenon of "mast sway," which can cause an antenna to move out of alignment with the antenna transmitting to it, thereby interrupting the link. An antenna with even a 43 dBi gain increases the likelihood that mast sway will lead to link disruption. Optimally, this problem can be solved simply by eliminating any minimum antenna gain requirement for above 95 GHz transmitters. If the Commission nonetheless believes that some type of minimum antenna gain is necessary, it should be no higher than 35 dBi.

Ericsson urges the Commission to consider making spectrum above 275 GHz available for fixed point-to-point service. The issue is already set for review at WRC-19, and, although several frequency bands in the 275-1000 GHz range have been identified for passive services, this does not preclude their use for active services. Lastly, the Commission's Suppliers Declaration of Conformity ("SDoC") procedure, not certification, should be used to authorize transmitter equipment in the above 95 GHz spectrum.

II. IN THE RACE TO 5G, HIGH-CAPACITY BACKHAUL IS AN ESSENTIAL INPUT, AND SPECTRUM ABOVE 95 GHz IS A PROMISING OPPORTUNITY.

The Commission recently observed that the race to 5G puts the United States "at the brink of another technological revolution."[5] The stakes are high: according to a recent report by CTIA, 5G will create three million new jobs, generate $275 billion in new investment, and

[5] *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*, Second Report and Order, FCC 18-30, ¶ 1 (rel. Mar. 30, 2018) ("*Wireless Deployment Second Report and Order*").

produce $500 billion of economic growth.[6] And GSMA estimates that the United States will reach 100 million 5G mobile connections in early 2023, with 5G becoming the leading mobile network technology across the country by 2025 (accounting for around half of total mobile connections).[7]

Importantly, Chairman Pai has pointed out that "5G infrastructure isn't just about small cells; it's also about backhaul."[8] And, increasingly, it is about wireless backhaul. With the advent of 4G, the Commission observed that as mobile data traffic increases, "carriers will need to increase their backhaul capacity, including microwave backhaul, to accommodate that traffic."[9] This will be even more true in the 5G era, given the capacity demands of increasingly data-rich use cases and the Internet of Things ("IoT").[10] The Ericsson Above 100 GHz Report projects that, "[b]y 2021, 65 percent of the world's cell sites (excluding those in northeast Asia) will be connected using microwave backhaul technology."[11] As the Commission has

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[6] CTIA 5G Report at 2. *See also Wireless Deployment Second Report and Order* ¶ 2.

[7] GSMA, *The 5G era in the US*, at 7 (2018), https://www.gsmaint-elligence.com/research/?file=-4cbbdb475f24b3c5f5a93a2796a4aa28&download.

[8] Ajit Pai, Chariman, FCC, Remarks at the Mobile World Congress, Barcelona, Spain at 3 (Feb. 26, 2018), https://apps.fcc.gov/edocs_public/attachmatch/DOC-349432A1.pdf.

[9] *Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses and to Provide Additional Flexibility to Broadcast Auxiliary Service and Operational Fixed Microwave Licensees*, Notice of Proposed Rulemaking and Notice of Inquiry, 25 FCC Rcd 11246, 11248 ¶ 3 (2010) ("*Wireless Backhaul Notice and NOI*").

[10] *See, e.g.,* John Naylon, *Why Wireless Backhaul Holds the Key to 5G*, Wireless Week (Mar. 15, 2016), https://www.wirelessweek.com/article/2016/03/why-wireless-backhaul-holds-key-5g ("[W]e can be certain that the aggregate data demand from the IoT will be in stark contrast to the smartphone-oriented experience of 3G and 4G. It is safe to say that capacity demands will grow and more base stations (whether macro or small cell) will be deployed to achieve the seamless quality of service (QoS) that [is] essential for IoT to be successful.").

[11] Ericsson Above 100 GHz Report at 2.

recognized, by increasing the supply of available spectrum for wireless backhaul, the Commission "can help ensure that wireless backhaul will be a viable and cost-effective option for meeting increased demand for backhaul services."[12]

As Chairman Pai recently observed, "recent advancements in propagation technology have changed the equation and expanded the boundary of usable spectrum. As a result, these very high-band frequencies are today's spectrum horizons."[13] Whereas today the 70/80 GHz band – 71-76 GHz paired with 81-86 GHz – is gaining popularity as a backhaul alternative with capacities in the 1-20 Gbps range over a few kilometers, higher frequencies offer even more promise.[14] In particular, spectrum above 95 GHz will become an increasingly valuable resource as wireless data rates approach 100 Gbps. While "[h]igher frequencies are more limited in terms of reach and coverage, . . . they can generally provide wider frequency bands, and as such have higher data-carrying capabilities."[15] And, as noted by the Commission, "the pace of development of technology for spectrum use above 95 GHz shall continue to increase."[16] Once new service and technical rules for the spectrum are in place, wireless networks will be in a position to take advantage of above 95 GHz opportunities as the necessary equipment is developed and brought to market.

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[12] *Wireless Backhaul Notice and NOI*, 25 FCC Rcd at 11248 ¶ 4.

[13] Ajit Pai, Chairman, FCC, *Innovation Month at the FCC*, FCC Blog (Feb. 1, 2018, 1:45 pm), https://www.fcc.gov/news-events-/blog/2018/02/01/innovation-month-fcc.

[14] *See* Ericsson Above 100 GHz Report at 3.

[15] *Id.*

[16] *Notice* ¶ 19.

III. THE PHYSICAL PROPERTIES OF SPECIFIC FREQUENCY BANDS ABOVE 95 GHz ARE WELL-SUITED FOR HIGH-CAPACITY BACKHAUL.

The anticipated exponential increases in data rates put a premium on unleashing new capacity in the above 95 GHz spectrum. Ericsson is working to enable the use of frequencies beyond 100 GHz for capacities in the 5-100 Gbps range over distances comparable to what 70/80 GHz achieves today.[17]

A. Above 95 GHz Spectrum is Promising for Wireless Backhaul Service Notwithstanding the Propagation Characteristics of the Spectrum.

The *Notice* properly recognizes that propagation in the millimeter wave bands is often challenging due to signal attenuation caused by atmospheric gases, but also notes that opportunities nonetheless exist.[18] There are several absorption "peaks" between 95 GHz and 275 GHz where attenuation is higher than normal (and thus where deployment of service is likely to be most difficult). The graph provided as Figure 1 illustrates this point. The colored lines on the graph show the gradual attenuation of signals up to 450 GHz, and where the attenuation peaks are located. The green ovals between the attenuation peaks correspond with the spectrum that the Commission is considering for licensed, fixed point-to-point service.[19] Not coincidentally, this spectrum falls where propagation conditions are most favorable. Ericsson therefore agrees that "it should be possible to deploy communication services throughout much of the spectrum between 95 GHz and 275 GHz" – namely, between the attenuation peaks.[20]

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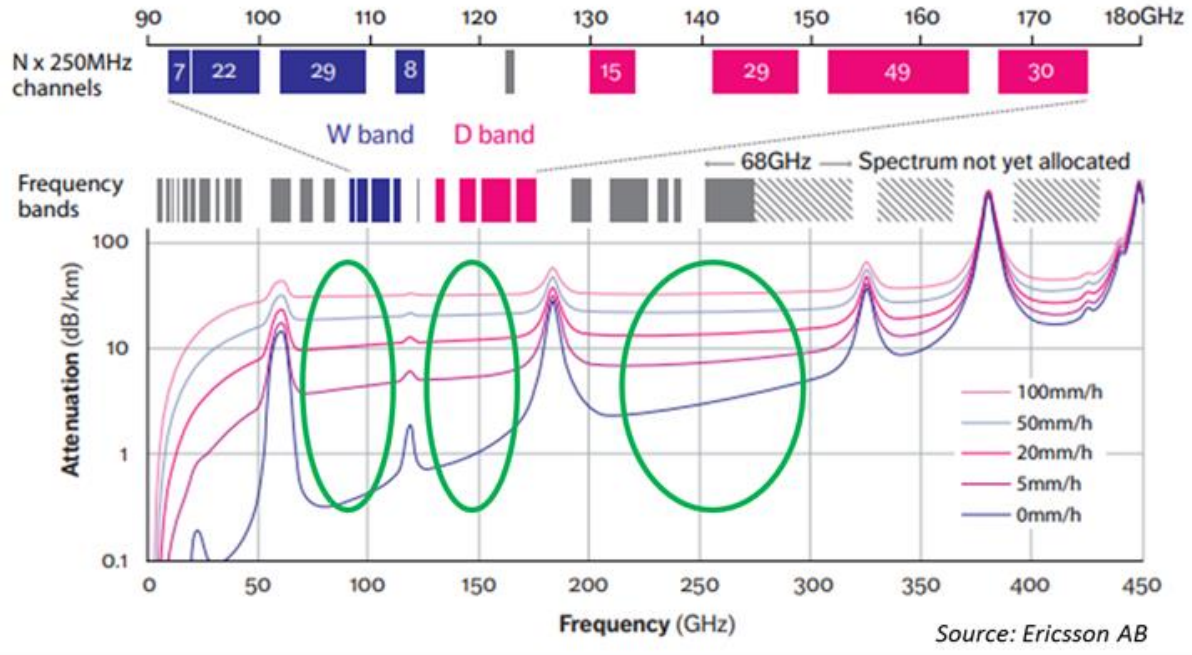
[17] *See* Ericsson Above 100 GHz Report at 2-5, 11-13.

[18] *Notice* ¶ 22.

[19] *Id.* ¶ 31; *see also* Section IV *infra.*

[20] *Notice* ¶ 23.

Figure 1—Attenuation Peaks and Communications Service Opportunities



In addition, signal attenuation under rain conditions increases only marginally beyond 70 GHz. As shown in Figure 1, rain attenuation at 50 millimeters per hour (mm/h) rain intensity increases less than 3 dB/km between the 70 GHz and 175 GHz bands and is almost constant beyond that.[21] For example, attenuation increases about 2 dB/km from 70 GHz to the "D-band" (130-174.8 GHz) and about 4 dB/km from 70 GHz to 275 GHz.[22] The free space path loss also increases with frequency: by about 6 dB from 70 GHz to the D-band and about 11 dB from 70 GHz to 275 GHz.[23] The propagation conditions thus are only slightly worse above 100 GHz.[24]

[21] The rain attenuation model used in Figure 1 is taken from ITU-R P838-3.

[22] Ericsson Above 100 GHz Report at 4.

[23] *Id.* at 4-5.

[24] *Id.* at 5.

Ericsson therefore fully supports the Commission's efforts to identify appropriate spectrum bands and technical rules that would allow wireless backhaul service to be provided above 95 GHz. To be sure, there are additional obstacles to overcome. For instance, design, manufacturing, and assembly methods must become much more precise in order to produce functional equipment. Dimensional tolerances in device packaging and interconnection become significantly more challenging due to the short wavelengths of frequencies above 100 GHz. These factors become even more important when considering the wide bandwidths across which the equipment must operate. Again, however, a meaningful portion of the spectrum between 95 GHz and 275 GHz should be suitable for wireless backhaul – and Ericsson is working to make backhaul a reality in these bands.

B. Ericsson is Already Exploring the Possibilities of the Above 95 GHz Spectrum.

Ericsson has been studying the above 95 GHz spectrum for some time and in 2017 published the "Ericsson Above 100 GHz Report," which focuses on the opportunities and challenges associated with achieving up to 100 Gbps capacity with spectrum above 100 GHz. To that end, Ericsson has been developing equipment for those frequencies. For example, Figure 2 below is a photograph of Ericsson's above 100 GHz test bed, which includes a prototype antenna that operates in the D-band.

Figure 2 – Ericsson Above 100 GHz Test Bed

Working with researchers at Chalmers University of Technology in Gothenburg, Sweden, Ericsson Research has developed a D-band transceiver module.[25] Figure 3 is a photograph of Ericsson's above 100 GHz demonstrator that gauges mean square error and bit error rates for different bandwidths and modulation formats versus received signal strength.

Figure 3—Ericsson Above 100 GHz Testing Equipment

[25] *Id.* at 10.

With these efforts, Ericsson is confident that high-capacity backhaul can become a reality in the above 95 GHz spectrum.

IV. TO ACHIEVE HARMONIZATION, THE COMMISSION SHOULD CONFORM ITS ABOVE 95 GHz BAND PLAN TO THE BAND PLANS ALREADY UNDER CONSIDERATION IN EUROPE.

The Commission has long recognized the benefits of global harmonization, which creates economies of scale that promote investment and innovation and result in lower-priced equipment. The Commission should pursue global harmonization for the above 95 GHz spectrum.

As an initial matter, Ericsson supports the Commission's proposal to make the following bands available for licensed, fixed point-to-point service: 95-100 GHz, 102-109.5 GHz, 111.8-114.25 GHz, 130-134 GHz, 141-148.5 GHz, 151.5-158.5 GHz, 158.5-164 GHz, 167-174.5 GHz,174.5-174.8 GHz, 191.8-200 GHz, 209-226 GHz, 231.5-232 GHz, 232-235 GHz, 238-240 GHz, 240-241 GHz, and 252-275 GHz.[26] In addition, Ericsson supports the Commission's focus on making above 95 GHz spectrum available on an unlicensed basis on frequencies located near the peaks of the atmospheric attenuation curve, which are of little interest to providers of licensed fixed or mobile services.[27]

Ericsson does not oppose the Commission's proposal to allow above 95 GHz applicants to request a license for any portion of any band,[28] but it nonetheless supports the development of band plans as an important means to provide structure to the above 95 GHz ecosystem. And, to

[26] *Notice* ¶¶ 31, 39. As pointed out in the *Notice*, the 158.5-164 GHz, 167-174.5 GHz, 191.8-200 GHz, 209-226 GHz, 232-235 GHz, 238-240 GHz and 252-275 GHz bands would be shared with the FSS or MSS. *Id.* ¶ 39. Ericsson believes that sharing between fixed, point-to-point service and FSS or MSS is feasible. *See* Section VI *infra.*

[27] *Notice* ¶ 55

[28] *Id.* ¶ 32.

advance harmonized spectrum, the Commission should adopt the band plans for the "W-Band" (92-114.25 GHz) and the D-Band (130-174.8 GHz) under consideration before the Electronic Communications Committee ("ECC") of the European Conference of Postal and Telecommunications Administrations ("CEPT").[29] Even with the flexibility proposed in the *Notice,* defined, harmonized band plans will enable equipment manufacturers to achieve the economies of scale that are essential to making cost-efficient global products.

The proposed European band plans for the W-Band and the D-Band both feature standardized frequency pairing. Figure 4 shows the band pairings for the W-Band. The band plan includes 29 paired channels and 8 unpaired channels. Blue, red or green spectrum blocks should be paired to the extent practical with the corresponding spectrum block. Channelization is based on 250 MHz channels, which may be aggregated to create wider channels. For operators using Time Division Duplex ("TDD") and not Frequency Division Duplex ("FDD") technology, any paired channel could be used for unpaired operation.

In addition, Figure 4 shows that the 92.25-94.0 GHz band would be paired with the 104.25-106.0 GHz band, and that the 94.45-97.95 GHz band would be paired with the 106.0-109.5 GHz band. Presently, the 92-94 GHz band and the 94.1-95 GHz band are available to non-federal users in the United States.[30] Accordingly, to achieve complete harmonization, most of

[29] *See* European Communications Office, To facilitate the deployment of fixed services links in the frequency blocks already allocated to fixed services in the frequency range 92 – 115 GHz, Work Item SE19_37, https://eccwp.cept.org/WI_Detail.aspx?wiid=534 (last visited May 1, 2018), and To facilitate the deployment of fixed services links in the frequency bands already allocated to fixed services: 130 – 134 GHz; 141 – 148.5 GHz; 151.5 – 164 GHz and 167 – 174.7 GHz, Work Item SE19_38, https://eccwp.cept.org/WI_Detai-l.aspx?wiid=535 (last visited May 1, 2018).

[30] *See* 47 C.F.R. § 101.1505(b).

that spectrum would need to be included in the W-Band band plan and paired as indicated in Figure 4.

Ericsson notes that Section 101.1507 of the Commission's rules pairs channels among the 70 GHz, 80 GHz and 90 GHz bands,[31] and as such, the rule appears to be a hurdle to pairing the 92-94 GHz and 94.1-95 GHz bands with spectrum above 100 GHz. Ericsson therefore asks the Commission to amend Section 101.1507 to clarify that the 92-94 GHz and 94.1-95.0 GHz bands may be included in the W-Band band plan, such that the 92.25-94.0 GHz and 94.45-97.95 GHz bands may be paired in a standardized manner with the 104.25-106.0 GHz and 106.0-109.5 GHz bands, respectively.

Figure 4—Band Plan Configuration for the W-Band

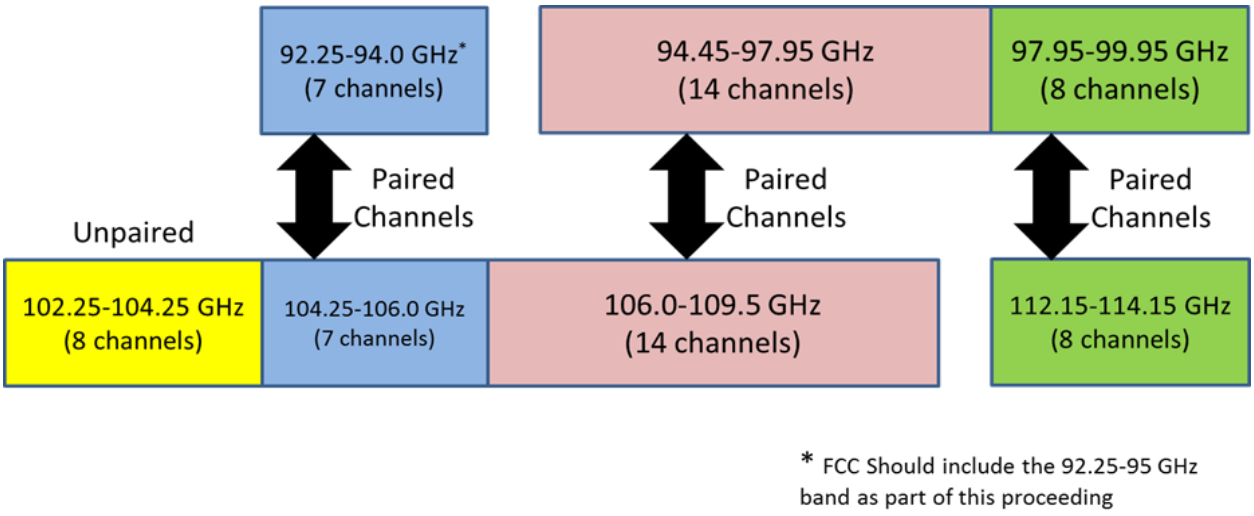
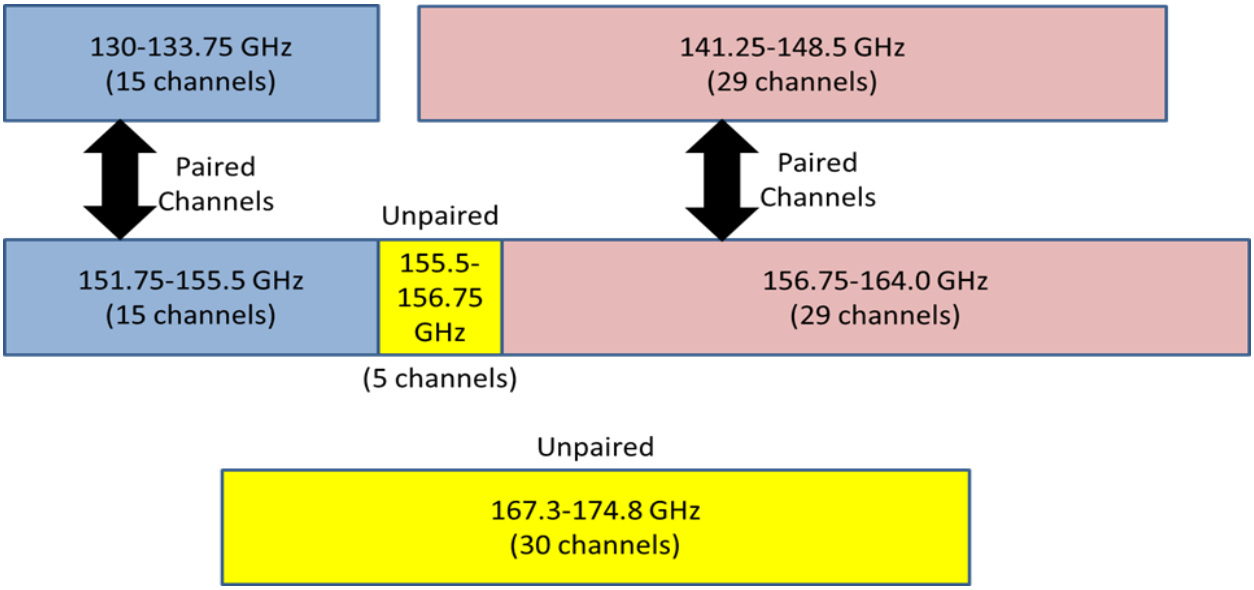


Figure 5 shows the band pairings in the proposed European band plan for the D-Band. As in the W-Band plan above, channelization is based on 250 MHz channels which may be aggregated. The D-band band plan includes 44 paired channels, and 35 unpaired channels. For operators not using FDD, any paired channel could be used for unpaired operation.

[31] *Id.* § 101.1507.

Figure 5—Band Plan Configuration for the D-Band



V. THE COMMISSION SHOULD ADOPT RULES FOR THE ABOVE 95 GHz SPECTRUM THAT ARE LARGELY BASED ON THE 70/80/90 GHz BAND RULES.

A. The Commission Should Use the 70/80/90 GHz Non-Exclusive Licensing and Link Registration Scheme for Fixed Point-to-Point Operations.

Ericsson supports the Commission's proposal to adopt rules for fixed point-to-point operations in above 95 GHz spectrum that are generally based on the rules currently in place for the 70/80/90 GHz bands.[32] Notably, this includes a non-exclusive nationwide licensing framework for point-to-point users and registration of individual point-to-point links with a third-party database manager.[33] Each non-exclusive nationwide license should have a ten year term, and construction of links should be completed within 12 months of link registration.[34] This basic

[32] *See Notice* ¶ 28.

[33] *Id.* ¶¶ 29-30.

[34] *Id.* ¶ 32.

framework has proven to be successful for 70/80/90 GHz point-to-point services and, given the technical similarities between those services and point-to-point services above 95 GHz, it should prove to be equally successful for above 95 GHz licensees.

Further, as proposed in the *Notice*, interference protection should be granted to the first-in-time registered non-federal link.[35] The third-party database manager would be responsible for coordinating with NTIA through an automated "green light/yellow light" mechanism to avoid interference to federal operations that share the above 95 GHz spectrum.[36] Relatedly, the Commission proposes to add a footnote to the Table of Frequency Allocations stating that "[f]ederal and non-federal users shall have equal rights to access the spectrum in the 95-275 GHz band," and that non-federal use of the band "shall not preclude or impair co-primary use of the bands by federal users and shall not establish non-federal priority in bands allocated for shared federal and non-federal use."[37] Ericsson asks the Commission to confirm that non-federal licensees at 95-275 GHz would have first-in-time rights, even with respect to federal users. Otherwise, the proposed footnote risks undermining investment and deployment above 95 GHz.

Lastly, Ericsson does not oppose deployment of fixed point-to-multipoint systems above 95 GHz provided that each link within such systems is registered as a discrete link (as opposed to issuance of a block license). Ericsson believes this is necessary to preserve the integrity and flexibility of the link registration system and avoid compromising the interference protection rights of point-to-point link registrants.

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[35] *Id.*

[36] *Id.* ¶ 29.

[37] *Id.* ¶ 51.

B. The Commission's Technical Rules Should Follow the 70/80/90 GHz Framework But Should Not Specify a Minimum Antenna Gain.

Ericsson further agrees that the 70/80/90 GHz technical rules provide an appropriate blueprint for the above 95 GHz technical rules. The *Notice*, however, includes two technical proposals that Ericsson does not support.

First, the Commission proposes to adopt a different transmitter power limit for above 95 GHz operations than in the 70/80/90 GHz rules. There, transmitter power is limited to 55 dBW irrespective of the bandwidth of the signal. For above 95 GHz operations, however, the Commission proposes to specify the power limit in terms of a maximum EIRP density, *i.e.*, 25 dBW/MHz (equal to that adopted for base stations in the Commission's Part 30 rules for UMFUS base stations (75 dBm/100 MHz EIRP)).[38]

As a general matter, Ericsson does not oppose the idea of increasing maximum EIRP for wider bandwidths. As compared to its 70/80/90 GHz power limit, however, the Commission's proposed power limit for the above 95 GHz spectrum is more restrictive for bandwidths below 1 GHz. As a result, even fixed point-to-point systems that use adaptivity (*e.g.*, adaptive bandwidth) to mitigate adverse propagation conditions would be affected by the Commission's proposal. In Ericsson's view, the transmitter power limit for above 95 GHz operations should not be more limited than that for 70/80/90 GHz, particularly given their technical similarities and the likelihood that they will be deployed for similar services (*e.g.*, backhaul). Moreover, defining the power limit as a fixed value across a signal's entire bandwidth (regardless of what that bandwidth is) will give above 95 GHz users more flexibility in how the power is distributed across that bandwidth. Ericsson thus proposes that the power limit for the above 95 GHz

[38] *Id.* ¶ 34.

spectrum should be 55 dBW. The related EIRP requirement for directional antennas (Section 101.115 of the Commission's rules) should be updated to capture this.

Second, the Commission requests comment on whether the Commission should require transmitters in the above 95 GHz spectrum to have an antenna gain of 50 dBi (*i.e.*, the minimum antenna gain required of 90 GHz transmitters) or 43 dBi (the minimum antenna gain required of 70/80 GHz transmitters).[39] But the Commission should refrain from adopting *any* minimum antenna gain requirement for transmitters in the above 95 GHz spectrum.

Given the expected increase in the use of small cells without dedicated mounting infrastructure, operators will seek to deploy antennas on structures that already exist in urban environments. And, with smaller antennas, above 95 GHz spectrum will be highly desirable for such deployments. Often such stations will be secured to lampposts, light poles, traffic sign masts, or other types of supporting structures, and equipment installed on such structures must be able to contend with the phenomenon of "mast sway." Mast sway can cause an antenna to move out of alignment with the antenna transmitting to it, thereby interrupting the link. It is particularly prevalent on thinner structures such as lampposts and light poles and is generally caused by heavy wind, although it may also occur from ground vibrations or heat expansion due to uneven solar irradiance.

Optimally, this problem can be solved simply be eliminating any minimum antenna gain requirement for above 95 GHz transmitters. If the Commission nonetheless believes that some type of minimum antenna gain is necessary, it should be no higher than 35 dBi, "which is the

[39] *Id.* ¶ 33.

recommended maximum antenna gain for sites with mast sway."[40] This would correspond to a 10 dB signal attenuation under a worst case 4% deviation of a light pole's height.[41]

VI. SHARING OF THE ABOVE 95 GHz SPECTRUM BETWEEN FIXED POINT-TO-POINT SERVICES AND OTHER LICENSED SERVICES SHOULD BE FEASIBLE.

As a general proposition, fixed point-to-point services above 95 GHz should be capable of sharing spectrum with other licensed services. The fixed point-to-point antennas used above 95 GHz will transmit very narrow "pencil beams," and the propagation properties of those transmissions substantially limit the length of the links. Thus, assuming proper coordination, the likelihood of interference from fixed point-to-point services to other licensed services is small, and vice-versa.

The Commission asks for comment on whether fixed point-to-point operations could share spectrum above 95 GHz with the radio astronomy service ("RAS").[42] Fixed service sharing with RAS is common today via use of exclusion zones. As the Commission points out, U.S. footnote 161 includes a list of RAS locations operating in the bands 81-86 GHz, 92-94 GHz and 94.1-95 GHz that are protected from fixed stations by the use of coordination distances. Currently, links in the 70/80/90 GHz range are coordinated by third party coordinators, which also coordinate with NTIA through an automated database system. Links that cause no interference issue are automatically approved. Ericsson believes a similar approach would work for above 95 GHz fixed stations, provided that the coordination distances are adjusted to

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[40] Ericsson Above 100 GHz Report at 8.

[41] *See* European Standard EN 40-3-2:2013, *Lighting columns – Part 3-2: Design and verification – Verification by testing* (Nov. 25, 2012).

[42] *Notice* ¶¶ 43-44.

acknowledge the propagation characteristics of the spectrum. Registration of RAS locations in the database for above 95 GHz operations could help expedite the coordination process.[43]

VII. THE COMMISSION SHOULD CONSIDER MAKING SPECTRUM ABOVE 275 GHz AVAILABLE FOR FIXED POINT-TO-POINT SERVICE.

Ericsson submits that the Commission can and should consider making spectrum above 275 GHz available for fixed point-to-point service. The issue is already set for review at WRC-19 – per Agenda Item 1.15, conferees will "consider identification of frequency bands for use by administrations for the land-mobile and fixed services applications operating in the frequency range 275-450 GHz, in accordance with Resolution 767 [COM6/14] (WRC-15)."[44] Resolution 767 invited the International Telecommunication Union ("ITU") Radiocommunication Sector ("ITU-R") to, *inter alia*, "identify technical and operational characteristics of systems in the land-mobile and fixed services operating at frequencies above 275 GHz" and to "develop propagation models within the frequency range 275-450 GHz so as to enable sharing and compatibility studies between the land-mobile, fixed and passive services in this frequency range."[45]

The Commission, moreover, has already established that even though several frequency bands in the 275-1000 GHz range have been identified for passive services, this does not preclude their use for active services:

> We recognize that the 275-3000 GHz frequency range is used and may be used more extensively in the future for experimentation

[43] For similar reasons, Ericsson also believes that the registration of satellite earth stations in the above 95 GHz database would be helpful. *Id.* ¶ 47.

[44] ITU, *World Radiocommunication Conference 2019 (WRC-19) Agenda and Relevant Resolutions*, at 3 (rev. Aug. 15, 2017) ("WRC-19") (Agenda Item 1.15), https://www.itu.int-/dms_pub/itu-r/oth/14/02/R14020000010001PDFE.pdf.

[45] ITU Resolution 767 (WRC-15) at 2; *see also* WRC-19 at 84.

> with, and development of, an array of active service applications. . . [W]e revise existing footnote US565 to identify expected passive uses of the 275-1000 GHz range and to clarify that this footnote does not establish any priority of use in the U.S. Table, and does not preclude or constrain any active service use or future allocation of frequency bands in the 275-3000 GHz range. *This clarifying text is sufficient, given that passive and active services can share frequencies above 275 GHz without constraints . . . .*[46]

Further, the 252-275 GHz frequency band is already allocated for fixed service. If, for example, the 275-320 GHz band were likewise made available for fixed service, it would form a continuous 68 gigahertz swath of spectrum that could be used for fixed service applications in the future.

VIII. THE COMMISSION SHOULD PERMIT ABOVE 95 GHz TRANSMITTER EQUIPMENT TO BE AUTHORIZED VIA ITS SUPPLIERS DECLARATION OF CONFORMITY PROCEDURE.

Ericsson believes that the Commission's SDoC procedure, not certification, should be used to authorize transmitter equipment in the above 95 GHz spectrum.[47] Certification is the Commission's most rigorous approval process for radiofrequency devices, and is used to authorize equipment with the greatest potential to cause harmful interference to radio services. By contrast, the SDoC process is less burdensome and is typically used for those types of equipment that are least likely to cause potential harmful interference to radio services. As noted, the narrow beamwidth of above 95 GHz antennas plus more difficult propagation conditions minimize the potential for such equipment to cause harmful interference, making them a good candidate for the Commission's SDoC process. And, in any case, under the

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[46] *Amendment of Parts 2, 15, 80, 90, 97, and 101 of the Commission's Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2012)(WRC-12), Other Allocation Issues, and Related Rule Updates*, Report and Order, 32 FCC Rcd 2703, 2720-21 ¶ 50 (2017) (emphasis added).

[47] *Notice* ¶ 86.

Commission's equipment authorization rules the responsible party has the option of using the certification procedure in place of the SDoC procedure. [48]

IX. CONCLUSION.

The quest to provide higher data-carrying capabilities has led to the use of higher frequencies where more spectrum is generally available, and this includes use of higher bands for high-capacity backhaul. The *Notice* is the next logical step in that process. Ericsson expects that large-scale deployments of above 100 GHz solutions will in the future support capacities up to 100 Gbps over distances up to a few kilometers.[49] The Commission should put the necessary regulatory framework in place now, both to support research and development and position the 95-275 GHz spectrum as a bona fide option for high-capacity backhaul for 5G networks. Ericsson thus supports the *Notice* and requests that the Commission adopt rules for the 95-275 GHz spectrum consistent with the recommendations set forth in these comments.

[48] In addition, Ericsson generally supports the Commission's proposal to create a new category of experimental licenses for spectrum in the 95 GHz to 3 THz range ("Spectrum Horizons Experimental Radio Licenses"). *See Notice* ¶¶ 63-81. Given the uncharted nature of this spectrum, the proposed licenses would offer more benefits than are available under conventional experimental licenses, such as longer license terms, license transferability and sale of equipment during market trials, provided that the equipment is registered.

[49] Ericsson Above 100 GHz Report at 13.

Respectfully submitted,

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